FBD - 12 - G1 - 19

Roll No. : ________

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197

Intermediate Part Second

MATHEMATICS (Objective) Group – I

Time: 30 Minutes Marks: 20

You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill the relevant circle in front of that question number on computerized answer sheet. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero marks in that question. Attempt as many questions as given in objective type question paper and leave other circles blank.

Q.1

	Questions	A	B	C	D
1	$\int e^x(\cos x + \sin x)\,dx =$:	$e^x \cos x$	$e^x \sin x$	$e^x \tan x$	$\ell n(\sin x)$
2	$\int (4-x^2)^{-\frac{1}{2}}(-2x)\,dx =$:	$2\sqrt{4-x^2}$	$\frac{1}{2}\sqrt{4-x^2}$	$\ell n\,(4-x^2)$	$\ell n\,\sqrt{4-x^2}$
3	$\int \ell nx\,dx =$:	$\frac{1}{x}$	$\frac{(\ell nx)^2}{2}$	$x\ell nx$	$x\ell nx - x + c$
4	$\int_0^x 3t^2\,dt =$:	t^3	$\frac{t^3}{3}$	x^3	0
5	$\frac{1}{\sqrt{x^2-1}}$ is derivative of:	$\sinh^{-1} x$	$\cosh^{-1} x$	$\tanh^{-1} x$	$\coth^{-1} x$
6	$\frac{d}{dx}(\ell n \cos x) =$:	$\tan x$	$\cot x$	$-\tan x$	$-\cot x$
7	If $y = \cosh x$, then $\frac{dy}{dx} =$:	$-\sinh x$	$\sinh y$	$-\cosh x$	$\sinh x$
8	$\frac{d}{dx}(f(u)) =$:	$f'(u)$	$f(du)$	$f'(u)\frac{du}{dx}$	$f'(u)du$
9	If $f(x) = 2x - 8$, then $f^{-1}(x) =$:	$8-2x$	$8+2x$	$\frac{x+8}{2}$	$\frac{x-8}{2}$
10	The function $x^2 + xy + y^2 = 2$ is a / an:	Constant function	Even function	Implicit function	Explicit function
11	$\lvert \underline{a} \times \underline{b} \rvert$ calculates the area of:	Triangle	Parallelogram	Tetrahedron	Parallelopiped
12	$\hat{k} \times \hat{i} =$:	$2\hat{i}$	$-\hat{i}$	$\hat{j}$	$-\hat{j}$
13	The end-points of minor axis of an ellipse are called:	Foci	Vertices	Covertices	Center
14	The vertex of the parabola $y^2 + 16x$ is:	(0 , 0)	(1 , 0)	(0 , 1)	(1 , 1)
15	The center of the circle $(x-1)^2 + (y+3)^2 = 9$ is:	(−1 , 3)	(−1 , −3)	(1 , 3)	(1 , −3)
16	The solution of the inequality $2x + y < 5$ is:	(1 , 2)	(2 , 1)	(2 , 3)	(5 , 0)
17	The perpendicular distance of a line $12x + 5y - 7 = 0$ from origin is:	$\frac{1}{13}$	$\frac{13}{7}$	$\frac{7}{13}$	13
18	The equation of line $\frac{x}{a} + \frac{y}{b} = 1$ is:	Normal form	Intercepts form	Point-slope form	Two-points form
19	The line $2x - y - 4 = 0$ cuts x-axis at point:	(2 , 0)	(0 , −2)	(0 , −4)	(4 , 0)
20	The distance between two points A (−8 , 3) , B (2 , −1) is:	116	(−6 , 2)	$2\sqrt{29}$	$\sqrt{58}$

FBD-12-G1-19

Intermediate Part Second Roll No. ________

MATHEMATICS (Subjective) Group – I

Time: 02:30 Hours Marks: 80

SECTION – I

2. **Attempt any EIGHT parts:** 16

(i) Define exponential function.

(ii) $f(x) = 2x + 1$, $g(x) = x^2 - 1$, find $g(f(x))$

(iii) Prove the identity $\cosh^2 x + \sinh^2 x = \cosh 2x$

(iv) Find by definition derivative of $\frac{1}{x - a}$

(v) Differentiate $\frac{(x^2+1)^2}{x^2-1}$ w.r.t. x

(vi) Find $\frac{dy}{dx}$ by making suitable substitution if $y = \sqrt{x + \sqrt{x}}$

(vii) Prove that $\frac{d}{dx}(\cos^{-1} x) = -\frac{1}{\sqrt{1-x^2}}$

(viii) Differentiate $\sin^3 x$ w.r.t. $\cos^3 x$

(ix) Find $\frac{dy}{dx}$ if $y = e^{-2x} \sin 2x$

(x) Find y_2 if $y = \sqrt{x} + \frac{1}{\sqrt{x}}$

(xi) Apply the Maclaurin series, prove $e^{2x} = 1 + 2x + 2x^2 + \ldots\ldots$

(xii) Determine the interval in which f is increasing or decreasing if $f(x) = 4 - x^2$, $x \in (-2, 2)$

3. **Attempt any EIGHT parts:** 16

(i) Find δy and dy of function $f(x) = x^2$ when $x = 2$ and $dx = 0.01$

(ii) Using differential find $\frac{dy}{dx}$ if $xy - \ln x = c$

(iii) Evaluate $\int (x+1)(x-3)\, dx$

(iv) Evaluate $\int \frac{1}{\sqrt{x}(\sqrt{x}+1)}\, dx$

(v) Evaluate $\int \frac{1}{1+\cos x}\, dx$, $\left(-\frac{\pi}{2} < x < \frac{\pi}{2}\right)$

(vi) Evaluate $\int \frac{x^2}{4+x^2}\, dx$

(vii) Evaluate $\int x \ln x\, dx$

(viii) Evaluate $\int x \sin x\, dx$

(ix) Evaluate $\int_{-1}^{3} (x^3 + 3x^2)\, dx$

(x) Evaluate $\int_{0}^{3} \frac{dx}{x^2+9}$

(xi) Define objective function.

(xii) Graph the solution set of linear inequality $2x + y \leq 6$

(Continued P/2)

FBD-12-G1-19

Attempt any NINE parts: 18

(i) Find the point trisecting the join of A (– 1 , 4) and B (6 , 2)
(ii) Find an equation of the line through A (– 6 , 5) having slope 7
(iii) Find the point of intersection of the lines $x - 2y + 1 = 0$ and $2x - y + 2 = 0$
(iv) Define the homogeneous equation.
(v) Find the radius of the circle $x^2 + y^2 - 6x + 4y + 13 = 0$
(vi) Find the equation of axis and focus of parabola $x^2 = -16y$
(vii) Find the foci of the ellipse $25x^2 + 9y^2 = 225$
(viii) Find the equations of directrices of hyperbola $\frac{x^2}{4} - \frac{y^2}{9} = 1$
(ix) Find the vector from point A to the origin where $\overrightarrow{AB} = 4\underline{i} - 2\underline{j}$ and B is the point (– 2 , 5)
(x) Define the direction cosines of a vector.
(xi) Find a unit vector in the direction of $\vec{V} = \underline{i} + 2\underline{j} - \underline{k}$
(xii) Find a scalar 'α' so that the vectors $2\underline{i} + \alpha\underline{j} + 5\underline{k}$ and $3\underline{i} + \underline{j} + \alpha\underline{k}$ are perpendicular.
(xiii) If $\vec{a} + \vec{b} + \vec{c} = 0$ then prove that $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$

SECTION – II Attempt any THREE questions. Each question carries 10 marks.

. (a) Find m and n so that the given function f is continuous at x = 3 $f(x) = \begin{cases} mx & \text{if } x < 3 \\ n & \text{if } x = 3 \\ -2x + 9 & \text{if } x > 3 \end{cases}$ 05

(b) If $y = (\cos^{-1} x)^2$, prove that $(1 - x^2)y_2 - xy_1 - 2 = 0$ 05

. (a) Evaluate $\int \frac{x - 2}{(x + 1)(x^2 + 1)}\, dx$ 05

(b) The average entry test score of engineering candidates was 592 in the year 1998 while the score was 564 in 2002. Assuming that the relationship between time and score is linear, find the average score for 2006. 05

. (a) Find the area bounded by curve $y = x^3 - 4x$ and the x-axis. 05

(b) Maximize : $f(x, y) = 2x + 5y$ subject to
Constraints : $2y - x \leq 8$, $x - y \leq 4$, $x \geq 0$, $y \geq 0$ 05

. (a) The vertices of a triangle are A (–2 , 3) , B (–4 , 1) and C (3 , 5). Find coordinates of the orthocenter of the triangle. 05

(b) Show that the lines $3x - 2y = 0$ and $2x + 3y - 13 = 0$ are tangents to the circle $x^2 + y^2 + 6x - 4y = 0$ 05

. (a) Find the equations of tangent and normal to the conic $\frac{x^2}{8} + \frac{y^2}{9} = 1$ at the point $\left(\frac{8}{3}, 1\right)$ 05

(b) Prove that $\cos(\alpha + \beta) = \cos\alpha \cos\beta - \sin\alpha \sin\beta$ 05

317-XII119-12000

FBD-R-G2-19

Roll No. : ________

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Intermediate Part Second

MATHEMATICS (Objective) Group – II

Time: 30 Minutes Marks: 20

Q.No.1 **You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill the relevant circle in front of that question number on computerized answer sheet. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero marks in that question. Attempt as many questions as given in objective type question paper and leave other circles blank.**

S.#	Questions	A	B	C	D
1	The lines through origin represented by $ax^2+2hxy+by^2=0$ are coincident if:	$h^2=ab$	$h^2+ab=0$	$h^2-ab>0$	$h^2-ab<0$
2	Slope of the line parallel to x-axis is:	Undefined	1	0	–1
3	Distance of the point (–2, 3) from y-axis is:	2	–2	3	–3
4	Intercept form of equation of a line is:	$\frac{x}{a}-\frac{y}{b}=0$	$\frac{x}{a}+\frac{y}{b}=0$	$\frac{x}{a}-\frac{y}{b}=4$	$\frac{x}{a}+\frac{y}{b}=1$
5	(1, 0) is not the solution of the inequality:	$x-3y<0$	$7x+2y<8$	$3x+5y<7$	$4x-3y<9$
6	Two circles are said to be concentric circles if they have:	Same radius	Different center	Same center	Same diameter
7	The latus rectum of the parabola $y^2=-4ax$ is:	$x=a$	$x=-a$	$y=a$	$y=-a$
8	The two separate parts of hyperbola are called:	Foci	Vertices	Directrices	Branches
9	$\underline{i}\times\underline{k}=$:	$-\underline{j}$	1	$\underline{j}$	0
10	The position vector of any point in xy-plane is:	$x\underline{i}+y\underline{j}+z\underline{k}$	$y\underline{j}+z\underline{k}$	$x\underline{i}+y\underline{j}$	$x\underline{i}+z\underline{k}$
11	Cosh 2x = :	$\frac{e^{2x}-e^{-2x}}{2}$	$\frac{e^{2x}+e^{-2x}}{2}$	$\frac{e^{x}+e^{-x}}{2}$	$\frac{e^{2x}-e^{-2x}}{e^{2x}+e^{-2x}}$
12	$\lim_{n\to+\infty}\left(1+\frac{1}{n}\right)^{2n}=$:	e	e^2	e^4	e^6
13	The notation used for derivative of f(x) by Cauchy is:	Df(x)	f′(x)	$\dot{f}(x)$	$\frac{df}{dx}$
14	If $y=\ell nx$ then $y_2=$:	$\frac{1}{x}$	$\frac{-1}{x}$	$\frac{-1}{x^2}$	$\frac{1}{x^2}$
15	$\frac{d}{dx}(e^{\sin x})=$:	cos x	$e^{\sin x}\cos x$	$e^{\sin x}\sin x$	sin x
16	$\frac{d}{dx}(\tan^{-1}3x)=$:	$\frac{1}{1+3x}$	$\frac{3}{1+3x}$	$\frac{1}{1+9x^2}$	$\frac{3}{1+9x^2}$
17	$\int x^{-1}dx=$:	$\ell nx+c$	$\frac{x^{-2}}{2}$	$-x^{-2}$	0
18	$\int e^x\left[\sinh^{-1}x+\frac{1}{\sqrt{1+x^2}}\right]dx=$:	$e^x\cosh^{-1}x$	$e^x\cos^{-1}x$	$e^x\sinh^{-1}x$	$e^x\sin^{-1}x$
19	$\int_0^1\frac{1}{1+x^2}dx=$:	$\frac{\pi}{3}$	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{\pi}{6}$
20	$\int\tan x\sec^2x\,dx=$:	$\tan x+c$	$\sec^2x+c$	$\sec x+c$	$\frac{\tan^2x}{2}+c$

318-XII119-12000

FBD-12-G2-19

Intermediate Part Second Roll No. ________

MATHEMATICS (Subjective) Group – II

Time: 02:30 Hours Marks: 80

SECTION – I

Attempt any EIGHT parts: 16

(i) Define implicit function.

(ii) Prove the identity $\text{sech}^2 x = 1 - \tanh^2 x$

(iii) Find $\lim\limits_{n \to 0} \dfrac{e^{\frac{1}{x}} - 1}{e^{\frac{1}{x}} + 1}$, $x > 0$

(iv) If $y = x^4 + 2x^2 + 2$, prove that $\dfrac{dy}{dx} = 4x\sqrt{y-1}$

(v) Differentiate w.r.t. x if $y = \dfrac{2x-3}{2x+1}$

(vi) Differentiate $x^2 - \dfrac{1}{x^2}$ w.r.t. x^4

(vii) Prove that $\dfrac{d}{dx}(\sin^{-1} x) = \dfrac{1}{\sqrt{1-x^2}}$

(viii) Find $\dfrac{dy}{dx}$ if $y = x \cos y$

(ix) Differentiate $y = a^{\sqrt{x}}$

(x) Find $\dfrac{dy}{dx}$ if $y = \ell n(\tanh x)$

(xi) Define point of inflexion of a function.

(xii) Determine $f(x) = \sin x$ is increasing or decreasing in the interval $\left(0, \dfrac{\pi}{2}\right)$.

Attempt any EIGHT parts: 16

(i) Find δy and dy in $y = \sqrt{x}$, when x changes from 4 to 4.41

(ii) Evaluate $\int \sin^2 x \, dx$

(iii) Integrate by substitution $\int \dfrac{x}{\sqrt{4+x^2}} dx$

(iv) Find the integral $\int \dfrac{\sqrt{2}}{\sin x + \cos x} dx$

(v) Evaluate the integral by parts $\int \ell nx \, dx$

(vi) Find indefinite integral $\int \dfrac{1}{\sqrt{a^2 - x^2}} dx$ by substitution

(vii) Evaluate $\int \dfrac{2a}{x^2 - a^2} dx$, $x > a$ by partial fraction

(viii) What is the definition of definite integral?

(ix) Calculate the integral $\int_{-1}^{5} |x-3| \, dx$

(x) Define order of a differential equation.

(xi) What do you know about half planes?

(xii) Graph the linear inequality $2x + 3 \geq 0$

(Continued P/2)

Attempt any NINE parts: 18

(i) Find the point P on the join of A (1 , 4) and B (5 , 6) that is twice as far from A as B is from A and lies on the same side of A as B does.
(ii) Show that the points A (– 3 , 6) , B (3 , 2) and C (6 , 0) are collinear.
(iii) Find an equation of the line through the points A (– 5 , – 3) and B (9 , – 1)
(iv) Find separate equations of lines represented by $6x^2 - 19xy + 15y^2 = 0$
(v) Define eccentricity of the conic.
(vi) Find equation of parabola with focus (– 1 , 0) , vertex (– 1 , 2)
(vii) Find equation of hyperbola with foci (± 5 , 0) vertex (3 , 0)
(viii) Define a circle.
(ix) Find sum of vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$ if A (1 , – 1) , B (2 , 0) , C (– 1 , 3) , D (– 2 , 2).
(x) Find a vector whose magnitude is 2 and is parallel to $-\underline{i} + \underline{j} + \underline{k}$
(xi) Find a scalar 'α' so that the vectors $2\underline{i} + \alpha\underline{j} + 5\underline{k}$ and $3\underline{i} + \underline{j} + \alpha\underline{k}$ are perpendicular.
(xii) Find area of triangle formed by P, Q, R if P (0 , 0 , 0) , Q (2 , 3 , 2) , R (– 1 , 1 , 4)
(xiii) Find α so that $\alpha\underline{i} + \underline{j}$, $\underline{i} + \underline{j} + 3\underline{k}$ and $2\underline{i} + \underline{j} - 2\underline{k}$ are coplanar.

SECTION – II Attempt any THREE questions. Each question carries 10 marks.

(a) Prove that $\lim\limits_{x \to 0} \dfrac{a^x - 1}{x} = \log_e a$; $a > 0$ 05

(b) If $x = a(\theta - \sin\theta)$; $y = a(1 + \cos\theta)$ then prove that $y^2 \dfrac{d^2y}{dx^2} + a = 0$ 05

(a) Evaluate $\int \tan^3 x \sec x \, dx$ 05

(b) Find the equations of two parallel lines perpendicular to $2x - y + 3 = 0$ such that the product of the x- and y-intercepts of each is 3. 05

(a) Evaluate $\int_0^{\sqrt{3}} \dfrac{x^3 + 9x + 1}{x^2 + 9} \, dx$ 05

(b) Indicate the solution region of the following system of linear inequalities by shading:
$3x + 7y \le 21$, $2x - y \ge -3$, $x \ge 0$ 05

(a) Find an equation of the line through the intersection of $16x - 10y - 33 = 0$, $12x + 14y + 29 = 0$ and the intersection of $x - y - 4 = 0$, $x - 7y + 2 = 0$ 05

(b) Write the equations of tangent and normal to the circle $x^2 + y^2 = 25$ at the point (4 , 3) 05

(a) Show that the ordinate at any point P of the parabola is mean proportional between the length of Latus rectum and abscissa of P. 05

(b) Prove that $\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$ 05